

10. Glossary

The definitions for the following terms are those commonly used in the transportation industry and particularly by the Alaska DOT&PF. Although some of these terms may seem fundamental, we provide them so that everyone, regardless of field experience, can develop an understanding of this nomenclature from this quick reference guide.

AASHTO: The acronym for the American Association of State Highway and Transportation Officials. A “T” designates AASHTO tests (example: AASHTO T195). An “M” designates AASHTO specifications (example: AASHTO M156).

Abrasion Testing: Aggregates break and erode as moved around by heavy equipment, plant machinery, and lay-down equipment. The Los Angeles abrasion machine tumbles the aggregate in a standard way to determine if the aggregate is hard enough to be made into processed aggregate. Refer to the current *Standard Specifications for Highway Construction*.

Absorption: Refers to the amount of asphalt absorbed into the aggregate in a mix, expressed as a percentage of aggregate.

Adhesion: The asphalt’s ability to stick to the aggregate in the paving mixture.

Affinity (Attraction) for Asphalt: An aggregate’s affinity, or attraction, for asphalt is its tendency to accept and retain an asphalt coating. Limestone, dolomite, and traprock have high affinities for asphalt and are referred to as hydrophobic (water-hating) because they resist the efforts of water to strip asphalt from them. Hydrophilic (water-loving) aggregates, such as quartz, have low affinities for asphalt. They tend to separate from asphalt films when exposed to water.

Aggregate: Any combination of one or more hard granular mineral materials, either natural or crushed, from very fine to large rocks. It is selected because of its characteristics for a specific purpose, such as sand, gravel, crushed stone, ballast, etc., used for mixing in graduated fragments. Types include:

Blended Aggregate: The combination of coarse and fine aggregates meeting gradation requirements for the material specified.

Coarse Aggregate: Typically, aggregate retained on the No. 4 sieve, but the designation is dependent on the specification requirements.

Coarse-Graded Aggregate: Aggregate having a continuous grading in sizes of particles from coarse through fine with a predominance of coarse sizes.

Dense-Graded Aggregate: An aggregate that has a particle size distribution near the maximum density line when plotted on a 0.45 power gradation chart.

Fine Aggregate: Aggregates passing the No. 4 or other specified sieve, but the designation depends on the specification requirements.

Fine-Graded Aggregate: Aggregate having a continuous grading in sizes of particles from coarse through fine with a predominance of fine sizes.

Mineral Filler: Very fine aggregate, predominantly P_{200} and free of organics.

Natural Aggregates: Aggregates in their natural form, with little or no processing.

Open-Graded Aggregate: One containing little or no mineral filler, in which the void spaces in the compacted aggregate are relatively large.

Poorly Graded Aggregates: An aggregate gradation with high variability in the amounts passing each successive sieve, having angles when plotted on a gradation chart.

Processed Aggregates: Aggregates that have been crushed and screened in preparation for use.

Synthetic Aggregates: Artificial aggregates that are the byproduct of industrial production processes such as slag from ore refining. The most common form is the lightweight aggregate used in concrete.

Well-Graded Aggregate: Aggregate graded from the maximum size down to filler with a smooth curve when plotted on a gradation chart.

Aggregate Loss: Refers to undesirable loss of aggregates in an asphalt pavement or surface treatment. The most common causes of aggregate loss from a pavement are lack of compaction, too little asphalt binder, lack of antistripping agents, poor quality aggregate, and dirty aggregate. In mixes using emulsified asphalt, aggregate loss may result from use of an inappropriate ionic grade.

Aggregate Storage Bins: Bins that store the necessary aggregate sizes for feeding to an asphalt plant in substantially the same proportions as are required in the finished mix. Also called **Cold Bins**.

Alaska Renewable Pavement (ARP): Pavement layering system that is an acceptable alternative to stabilized base or can be used to amplify the benefits of a stabilized base. ARP can also be combined with a bound stabilized base or asphalt-treated base to satisfy requirements for pavement designs involving very high ESALs. The ARP system is similar to normal asphalt concrete pavement except that it is thicker and is actually composed of two sublayers. The ARP design provides for very long service life because the ARP concept anticipates periodic replacement of the upper ARP layer by mill-and-fill construction methods.

Anionic: A material with a negative electrical charge (see **Emulsified Asphalt**).

Antistripping Agents: Antistripping agents are usually blended with asphalt binders to improve bonding between the binder and the aggregate. Lime and cement are among the most common antistripping agents. Chemical antistripping agents such as *PaveBond* or *Arr-Maz* are also commonly used in Alaska. Asphalt cement suppliers usually add the chemical antistripping agents.

Arctic-Grade Asphalt: Refers to paving asphalt cement that has been modified, usually by rubber derivative materials such as latex or polymer, for enhancing low-temperature characteristics. Arctic-grade asphalt has been used, with varied success, to reduce thermal cracking of pavement in cold climates. A standard grading system has not yet been developed for arctic grades.

Asphalt: A dark brown to black cementitious material in which the predominating constituents are bitumens that occur in nature or are obtained as residue in petroleum distillation. Asphalt imparts controllable flexibility to mixtures of mineral aggregates, with which it is usually combined. It is highly resistant to most acids, alkalis, and salts. Although it is a solid or semisolid at ordinary atmospheric temperatures, asphalt may be liquefied by applying heat, dissolving it in petroleum solvents of varying volatility, or emulsifying it.

Asphalt Blocks: Asphalt concrete molded under high pressure. The type of aggregate mixture composition, amount and type of asphalt, and the size and thickness of the blocks are varied to suit usage requirements.

Asphalt, Blown or Oxidized: Asphalt that is treated by blowing air through it at an elevated temperature to give it desired characteristics for special uses such as roofing, pipe coating, undersealing Portland cement concrete pavements, membrane envelopes, and hydraulic applications.

Asphalt, Catalytically Blown: An air-blown asphalt produced by using a catalyst during the blowing process.

Asphalt Cement: Asphalt that is refined to meet specifications for paving, industrial, and special purposes. The term is often abbreviated to AC or referred to as binder when used in an asphalt hot mix.

Asphalt Cement Grade: See **Binder Classification**.

Asphalt Concrete: Also referred to as asphalt concrete pavement (ACP), hot mix asphalt (HMA), flexible pavement, and hot bituminous pavement. It is the material most commonly used for surfacing roadways and

airports in Alaska that are subject to high traffic. It is a high-quality, controlled, hot mixture of asphalt cement and graded aggregate, thoroughly compacted into a uniform dense mass.

Asphalt Content: Refers to the content of asphalt cement in an asphalt concrete paving mixture. Asphalt content is currently always expressed as a percentage of the total mix weight. In the 1970s and earlier, the Alaska DOT&PF expressed asphalt contents as a percentage of the aggregate weight.

Asphalt, Cutback: See **Cutback Asphalt**.

Asphalt Distributor: A truck-mounted asphalt tank including heating elements, a pump, and a spray bar on the back for spraying asphalt on a prepared surface. The asphalt distributor applies the desired volume of asphalt (liters /sq. m or gal./sq. yd.) for asphalt surface treatments, tack coats, and prime coats.

Asphalt Filler, Preformed: Premolded strips of asphalt mixed with fine mineral substances, fibrous materials, cork, sawdust, or similar materials; manufactured in dimensions suitable for construction joints.

Asphalt Joint Sealer (Filler): An asphalt product used for sealing cracks and joints in pavement and other structures.

Asphalt Leveling Course: A course (asphalt aggregate mixture) of variable thickness used to eliminate irregularities in an existing asphalt surface prior to placing the final wearing course.

Asphalt Plants: See **Batch Plant** and **Drum Mix Plant**.

Asphalt Soil Stabilization (soil treatment): Treatment of naturally occurring nonplastic or moderately plastic soil with cutback or emulsified soil mixture produces water-resistant base or subbase courses of improved load-bearing qualities.

Asphalt Surface Treatments: A broad term for several types of asphalt or asphalt-aggregate applications, usually less than 1 inch thick, to a road surface. The types range from a single application of emulsified asphalt followed by graded aggregate to multiple surface layers made up of alternating applications of asphalt and different-sized aggregates. See also **Single Surface Treatments** and **Multiple Surface Treatments**.

Asphalt-Treated Base: A base course constructed using hot asphalt cement as a binder, often referred to as ATB. See **Treated Base Courses** for further descriptions of types.

Asphaltenes: The high molecular weight hydrocarbon fraction of asphalt.

ASTM: The acronym for the American Society for Testing and Materials.

ATM: Stands for Alaska Test Methods. These tests were developed by the headquarters Materials section. ATM tests are designated with a “T” (Example: ATM T-4).

Automatic Cycling Control (batch plant): In a batch plant, a control system in which the opening and closing of the weigh hopper discharge gate, the bituminous discharge valve, and the pug mill discharge gate are actuated by self-acting mechanical or electrical machinery without any intermediate manual control. The system includes preset timing devices to control dry and wet mixing cycles.

Automatic Dryer Control (batch plant): In a batch plant, a system that automatically maintains the temperature of aggregates discharged from the dryer within a preset range.

Automatic Proportioning Control (batch plant): In a batch plant, a system in which proportions of the aggregate and asphalt fractions are controlled by gates or valves that are opened and closed by self-acting mechanical or electronic machinery without any intermediate manual control.

Annual Average Daily Traffic (AADT): The average volume for a 24-hour period. It is normally the annual total volume divided by 365, unless otherwise stated.

Axle Load: The total load transmitted to the pavement by all wheels of either a single or tandem axle, usually expressed in kips (1 kip = 1 kilo pound = 1,000 pounds of force).

Bag House: A contained fabric filter that removes dust from the exhaust gases of dryer drums on batch plants and drum plants. The fabric filters are sewn in the shape of cylindrical bags, several hundred of which are contained in the bag house. Bag houses are used to avoid air pollution during hot mix asphalt production. Bag houses are equipped with mechanical means of shaking and cleaning the filters during production of mix.

Bag House Fines: The dust that falls out of the bag house, off the filters. This material may be fed back in to the asphalt mix or wasted. Wasted bag house fines are often put into contained settling ponds.

Bank Gravel: Gravel found in natural deposits, usually intermixed with fine material such as sand or clay, or combinations thereof. Gravelly clay, gravelly sand, clayey gravel, and sandy gravel indicate the varying proportions of the materials in the mixture.

Base Course (BC): The layer or layers of specified material of designed thickness placed on a subbase or a subgrade to support a surface course. Most base courses are constructed with crushed aggregates and therefore called crushed aggregate base course.

Batch Plant: A stationary manufacturing facility for producing asphalt paving mixtures that proportions the aggregate constituents into the mix by screening and weighing batches, then adds asphalt material by either weight or volume in a pug mill. Batch plants make asphalt concrete one batch at a time. Measured quantities of aggregates are first run through a dryer drum and into hot bins for storage. A bag house filters dust emitted from the dryer drum. The aggregates are then sent through hot screens to control the gradation and dropped into a pug mill where they are mixed with hot asphalt. The batch is dumped from the pug mill and the process repeats. Dumped batches are either placed directly into trucks or conveyed to a silo for storage. Because batch plants are stationary facilities, they are usually only found in larger metropolitan areas where demand keeps them in operation. Batch plants are rated according to the maximum batch weight in tons they can produce and the weight they can produce per hour. Larger batch plants can produce five tons or more of mix with each batch and more than 300 tons per hour.

Binder: Material used to stabilize or cement together loose soil or aggregate. In hot mix asphalt and asphalt treated bases, the binder is asphalt cement.

Binder Classification (Grades): Refers to an asphalt cement's specification grade. The first developed grading system was penetration grading, followed by viscosity grading. Viscosity grading may be done on original asphalt (AC-grades—Note: AC-10 is seldom used), or on asphalt residue from the rolling thin film oven (AR-grades). Other grades include arctic grades, performance-based asphalt (PBA-grades), performance-graded (PG-grades), and modifications of the above.

Superpave Binder: See **Performance-Graded Asphalt**.

Binder Course: Where thick pavements are required, the asphalt concrete pavement is sometimes placed as two layers, each differing in composition but sharing approximately the same fatigue properties (see also **Wearing Course**). The binder course is the bottom portion of asphalt concrete pavement, “tuned” to provide maximum fatigue resistance (addresses fatigue cracking) and minimum plastic deformation (addresses displacement rutting).

Bitumen: A mixture of hydrocarbons that occur naturally or result from chemical processing. Asphalt and tar are examples.

Bituminous Surface Treatment (BST): See **Multiple Surface Treatments**.

Bleeding or Flushing: The upward movement of asphalt in an asphalt pavement or surface treatment, resulting in the formation of a film of asphalt on the roadway surface. The most common cause is too much asphalt in one

or more of the pavement courses, resulting in asphalt coming to the surface under traffic and with heat expansion. Bleeding or flushing usually occurs in hot weather.

Block Cracks: See **Cracks**.

Blotter Material: Fine material (clean sand, crusher dust, etc.) sometimes spread on an uncured prime coat to allow traffic on the prime before it is cured and to protect the uncured prime from being washed off the grade by rain. You may use blotter sand less than four hours after applying the prime only with written permission. Blotter material may also be used to mitigate bleeding.

Breaking: The process of emulsified asphalt curing or setting by evaporation.

Break-Down Roller: The large roller that is the first to start compaction of freshly laid asphalt concrete pavement. Often vibratory rollers are used for the first few passes of break-down rolling.

Cape Seal: Cape seal combines a single-shot asphalt surface treatment with a slurry seal or microsurfacing. Done properly, it provides the rough, knobby surface of a chip seal to reduce hydroplaning, yet has a tough sand matrix for durability.

Cationic: A material testing positive in a particle charge test (see **Emulsified Asphalt**).

Check Marshall Test: *Alaska uses this test method.* The Check Marshall Test is made on the asphalt concrete that is produced on the project to determine if it has sufficient stability. (Stability is a measure of the pavement sample's diametral strength.) The Marshall method verifies the optimum asphalt content for a particular blend of aggregate. The method also provides information about the properties of the resulting asphalt hot mix, density, and void content that must be met during pavement construction. The job mix formula establishes optimum levels of density and void content. Check Marshall Testing is done by the Regional Laboratory.

Chips: Small angular fragments of stone containing little or no dust. They are used in asphalt surface treatments. See Table 7035 of the *Standard Specifications for Highway Construction*, 1988.

Chip Seal: See **Single Surface Treatments**.

Cohesion: The ability of the asphalt to hold the aggregate particles firmly in place in the finished pavement.

Cold Feed: Refers to the conveyors between the aggregate bins and the drum mixer or dryer drum in an asphalt plant that carry cold aggregates to the plant.

Cold-laid Plant Mixture: Plant mixes, using emulsified asphalt, that may be spread and compacted at atmospheric temperature.

Cold Mix: A mixture of emulsified asphalt and aggregate used for patching. This mixture is workable at temperatures above freezing.

Cold Recycling: Cold mix recycling may be done in place or at a central plant with a pug mill. Existing asphalt pavement is crushed to a specified maximum size and placed on the roadway with or without the addition of emulsified asphalt. When a train of equipment performs the crushing, treating, and relaying of the material, it is referred to as cold in place recycling (CIPR).

Compaction: Achieving density by compressing material into a smaller volume. The compaction process begins with break-down rolling, then intermediate rolling, and finally finish rolling. The percentage of compaction attained by the rolling of the hot mix can be estimated with a nuclear densometer, but is usually measured for acceptance by coring out samples whose density is measured in a laboratory and related to a maximum (Rice) density.

Composite Pavement: A pavement structure composed of an asphalt concrete wearing surface and Portland cement concrete slab.

Continuous Mix Plant: A manufacturing facility for producing asphalt paving mixtures that proportions aggregate and asphalt constituents into the mix by a continuous system without definite batch intervals. Also called a drum mix plant. See the definition for **Drum Mix Plant** for further details.

Coring Machine: Coring machines are used to remove core samples of the completed mix, which are tested to measure the level of pavement compaction and thickness for acceptance.

Cracks: Breaks in the surface of an asphalt pavement. The common types are:

Alligator cracks: A slang term for fatigue cracking of asphalt concrete pavement that results in interconnected cracks forming a series of small shapes that resemble an alligator's skin. In some places outside Alaska, these are referred to as "turtleback" cracks. Traffic loads that exceed the structural strength of the roadway section cause these cracks.

Block cracks: Interconnected cracks, sometimes called "shrinkage cracks," forming a series of large blocks, usually with sharp corners or angles. Shrinkage and daily temperature cycles cause them. Block cracking is a sign that the asphalt has aged and hardened significantly. It often occurs on older pavement with little or no traffic.

Construction Joint Cracks: Longitudinal or transverse separations along the seam between two paving panels, caused by a weak bond between the panels and/or lack of compaction at the joint.

Edge Joint (Curb Line) Cracks: The separation of the joint between the pavement and the shoulder, commonly caused by the wetting and drying beneath the shoulder surface. Other causes are shoulder settlement, mix shrinkage, and trucks straddling the joint. Longitudinal cracks between the traveled way and a paved shoulder may be caused by use of a different structural section of the shoulder or inadequate snow removal on the shoulders.

Fatigue Cracks: Interconnected cracks forming a series of small blocks resembling an alligator's skin or chicken wire. They are caused by heavy traffic that is excessive for the given thickness of pavement and structural support provided by underlying layers.

Longitudinal Cracks: Cracks that run in the direction of travel.

Reflection Cracks: Cracks in asphalt overlays that reflect the crack pattern in the pavement structure underneath. They are caused by vertical or horizontal movements in the pavement beneath the overlay, brought on by expansion and contraction with temperature or moisture changes. Lack of support for an overlay over an existing crack also contributes to reflection.

Slippage Cracks: Crescent-shaped cracks that are open in the direction of the thrust of wheels on the pavement surface. They result from braking and turning on pavement that lacks a good bond between the surface layer and the course beneath.

Thermal Cracks: See **Transverse Cracks**.

Transverse Cracks: Cracks that run perpendicular to the direction of traffic. Unless caused by a poor construction joint, these cracks are usually caused by longitudinal shrinkage of the pavement and the support layers when at very low temperatures.

Crack Sealing: Pavement maintenance operations, cleaning out cracks, and using asphalt materials to fill and seal cracks to impede infiltration of moisture into the supporting layers. Modern crack sealing compounds contain rubberized agents to help maintain flexibility even at very low temperatures.

Critical Fines Content (P_{cr}): The limiting fines content (P_{200}) above which frost action affects the strength of the pavement structure. The critical fines content (P_{cr}) varies with the depth below the surface course.

CRS-2: A cationic, rapid-setting emulsified asphalt, used primarily for fog seals, sand seals, and chip seals.

Crusher-Run: The unscreened product of a rock crusher.

Curing: In asphalt concrete, curing involves the chemical and physical changes the mix goes through as it cools and is initially subjected to traffic. See **Cutback Asphalt** and/or **Emulsified Asphalt**. Also see **Breaking**.

Cutback Asphalt: Cutback asphalt has been liquefied by blending with naphtha, kerosene, or fuel oil to allow mixing or spraying at lower temperatures than those for pure asphalt. Cutback asphalt cures by the evaporation of the solvent, which amounts to 33% to 50% by weight of the material. There are potential environmental problems with its use. Currently, cutback asphalt is only used for prime coat and some crack sealing. The following grades of cutback asphalt are standard:

Medium-Curing (MC) Asphalt: Cutback asphalt composed of asphalt cement and kerosene-type diluent of medium volatility. Example: MC-30 is sometimes used for prime coat.

Rapid-Curing (RC) Asphalt: Cutback asphalt composed of asphalt cement and a naphtha or gasoline-type dilutant that will evaporate quickly. Example: RC-800 has been used for crack sealing.

Road Oil: A heavy petroleum oil, usually one of the slow-curing (SC) grades

Slow-Curing (SC) Asphalt: Cutback asphalt composed of asphalt cement and oils of low volatility. Example: SC-250 has been used to control dust on gravel roads. However, it is no longer used due to concern that contaminated runoff may get into waterways.

Note: The numbers following the acronyms above refer to the viscosity grade of the material. Higher numbers indicate higher viscosity cutbacks.

Degradation Test: The degradation test determines the durability of aggregate in the presence of water and agitation during construction. Degradation values of 20 to 45 may be susceptible to degradation. Below 20, the material will be susceptible to degradation.

Density: The unit weight of a material in terms of mass per unit volume, e.g., lbs/ft³. The density of a compacted asphalt paving mixture is determined on laboratory-compacted specimens to:

- Provide a basis for computing the percentage of air voids and voids in the mineral aggregate in the compacted mixtures, an integral part of some asphalt paving mixture design procedures
- Provide an indication of the optimum asphalt content in some mix design procedures
- Establish a basis for controlling compaction during construction of the asphalt pavement
- Provide a basis for calculating the spread required for a given thickness of pavement
- Check density of pavement and effectiveness of rolling operations, on specimens obtained from pavements

Densification: Increasing the density of a mixture during the compaction process.

Design Lane: The lane on which the greatest number of equivalent 18,000-pound single-axle loads is expected. Normally this will be either lane of a two-lane roadway or an outside lane of a multilane highway.

Distortion: Change in the pavement surface.

Distributor: See **Asphalt Distributor**.

Double-Shot Seal Coat: See **Multiple Surface Treatments**.

Drainage: The ability of a structural section to allow moisture to be removed from its surface, subsurface, or roadway edges. The level of drainage provided by design, construction, and maintenance of a paved section is the most important factor in determining how long it will last.

Drainage Coefficients: Factors used to modify layer coefficients in the AASHTO pavement design process as an indicator of how well the pavement structure can handle the adverse effect of water infiltration.

Drum Mix Plant: Drum mix plants (sometimes called “dryer drum plants”) combine and heat aggregate and asphalt cement continuously. May also be called a continuous mix plant. Measured amounts of different-sized aggregates are fed into the upper end of the dryer. The asphalt cement is added near the middle of the drum, where it mixes with aggregate that has already been heated and dried. The aggregate at a drum plant starts at a set of cold bins, just as it does at a batch plant. The hot asphalt storage tanks and pumping systems are also similar to those for batch plants. The drum mixer consists of a revolving cylinder lined with flites, a large burner, and a fan, like a batch plant dryer. Unlike batch plant dryers, asphalt cement is sprayed on the aggregate and mixed within the drum. The burner is at the upper end of the dryer, so the aggregate and the hot gases move down through the drum. This is known as “parallel flow.” Parallel flow and a short flame are used so that the gases are cool enough by the time they reach the lower end of the drum that they will not burn the asphalt. Most drum-mix plants have an inlet, near where the asphalt is applied, to allow the addition of recycled asphalt pavement (RAP). Hot-mix asphalt that comes out the lower end of the drum is conveyed to truck loading facilities or a silo for storage. A bag house filters dust emitted from the lower end of the drum. Drum-mix plants are portable and are the most common type of asphalt plant used in Alaska, especially outside larger cities.

Dryer: An apparatus that dries the aggregates and heats them to the specified temperatures in batch plants.

Dry Mixing Time: Residence time of aggregate as it drops into the pug mill of a batch plant, before the addition of asphalt.

Ductility: The ability of a substance to be drawn out or stretched thin without breaking. Many types of asphalt grading use ductility tests.

Durability: Asphalt paving mixture’s ability to resist disintegration with age, weathering, and traffic. Time and low traffic volumes affect pavement’s durability. Included under weathering are changes in the characteristics of the asphalt, such as oxidation and volatilization, and changes in the pavement and aggregate due to water, including freezing and thawing.

Dust Control: Dust control operations use spray trucks equipped with stirring mechanisms and graders.

Dust Palliative: The use of a dilute asphalt emulsion (used motor oils are also an accepted form), sprayed directly on an unpaved road surface to control dust, is known as dust laying or the application of a dust palliative. The dilution depends on the condition of the surface. Some penetration is expected.

Dust Ratio: An asphalt mix property used for assessing acceptance during the mix design process. It is the number resulting from dividing the percentage P_{200} in the aggregate gradation by the percentage of asphalt as a percentage of mix. Typical acceptable values range from 0.6 to 1.2.

Effective Asphalt Content: The amount of asphalt in a paving mix not absorbed by the aggregates. It is the portion of asphalt available for coating and adhesion between aggregate particles.

Embankment Foundation: The material below the original ground surface whose physical characteristics affect the support of the embankment.

Emulsified Asphalt: Emulsified asphalt is made by combining ground asphalt, emulsifying agents, and water. It cures by “breaking,” which is water removal by evaporation or steaming off. Asphalt emulsions fall into three categories: anionic, cationic, and nonionic. The first two types are ordinarily used in roadway construction and maintenance. The anionic (electronegatively charged) and cationic (electropositively charged) classes refer to the electrical charges surrounding the asphalt particles. With nonionic emulsions, the asphalt particles are neutral. Cationic emulsions are used with aggregates that are negatively charged. Anionic emulsions are used with positively charged aggregates. Opposite charges attract. The relative setting time of either slow setting (SS), medium setting (MS), or rapid setting (RS) emulsions further categorizes emulsified asphalts.

Emulsified Asphalt Specifications: AASHTO and ASTM have developed standard specifications for the following grades of emulsions:

Emulsified Asphalt	Cationic Emulsified Asphalt
RS-1	CRS-1
RS-2	CRS-2
MS-1	—
MS-2	CMS-2
MS-2h	CMS-2h
HFMS-1	—
HFMS-2	—
HFMS-2h	—
HFMS-2s	—
SS-1	CSS-1
SS-1h	CSS-1h

The “h” that follows certain grades means a harder base asphalt is used. The “HF” preceding some of the MS grades indicates high float. The “s” that follows certain grades means it contains solvent or other oil distillates intended to improve coating of aggregates. If a polymer additive is included in the emulsion, the letter “p” is added.

Emulsified Asphalt Treated Base: A product of mixing base course material with emulsified asphalt and sometimes a few percent Portland cement. It can be mixed on grade by heavy equipment or by specially made traveling plants. It can also be produced in a central mixing plant. Emulsified asphalt treated bases bind up P_{200} in base course material and reduce frost and high moisture. They also can create an effective structural support layer so that the otherwise required thickness of pavement or subbase can be reduced.

Emulsion: A suspension of solids in water.

Emulsion Slurry Seal: A mixture of emulsified asphalt, fine aggregate, and mineral filler with water added to produce a slurry that is applied to a previously paved surface.

Equivalent Single Axle Loads (ESAL): Traffic on highways and streets varies in the number of vehicles and in the magnitude of loading. The cumulative effects of traffic loads factor in the structural design of pavement. The effect on the pavement performance of any combination of axle loads is equated to the number of standard 18,000-pound, dual tired, single-axle loads required to produce an equivalent effect (i.e., the single axle load). In design of pavement structural sections, the total number of ESALs is a summary of equivalent 18,000-pound single-axle loads expected from the combination of all vehicle classes for the design period.

Excess Fines: The fines content above the critical fines content ($P_{200} - P_{cr}$).

Excess Fines Factor (EFF): A factor that includes the effects of the excess fines and the applied stress at a given depth ($\Delta \text{SFR})(P_{200} - P_{cr})^{0.8}$.

Extraction: The procedure separating the asphalt from the mineral aggregates in an asphalt paving mixture using a chemical solvent, such as trichloroethylene. Extraction provides a basis for determining the asphalt content of a mixture and provides asphalt-free aggregates for a gradation analysis. Trichloroethylene and other chlorinated solvents are now considered hazardous and they are no longer used in Alaska DOT&PF laboratories. We now use ignition ovens and nuclear asphalt content gauges to determine asphalt contents. You may use a closed-system extraction method using toluene when gradation or asphalt recovery is necessary.

Falling Weight Deflectometer (FWD): A trailer-mounted device that drops a known weight from known heights on a pavement surface while automatically measuring the resulting peak stress and deflections. The drop stress is usually intended to simulate dynamic traffic loading. The data collected with the FWD back-calculates elastic

moduli of the supporting layers. Once the elastic moduli are known, structural design can proceed to determine critical stresses and strains in the structure.

Fatigue Cracking: See **Cracking**.

Fatigue Resistance: The ability of asphalt pavement to withstand repeated flexing or slight bending caused by the passage of wheel loads. As a rule, the higher the asphalt content and the lower the air void content in an asphalt mix, the greater the fatigue resistance. However, a mix with too high an asphalt content or too low an air void content will tend to rut under traffic loading.

Fat Spots: Fat spots in an asphalt mixture are isolated areas where asphalt cement has come to the surface of the mix during the lay-down and compaction. These spots can occur erratically, or they may be numerous and regular. Excessive moisture in the mix or the accumulation of asphalt cement on the plant lay-down machines or rollers that drop the accumulation on the mat can also cause fat spots.

Fines Content (P_{200}): The average percentage by weight of material passing the No. 200 sieve.

Flash Point: Asphalt cement, if heated to a high enough temperature, will release fumes that flash in the presence of a spark or open flame. This temperature, the flash point, is well above the temperatures normally used in paving operations. The Cleveland Open Cup is a flash point test used in grading asphalt. The results ensure safety during mixing and handling of asphalt.

Flexibility: The ability of an asphalt pavement structure to conform to settlement of the foundation. It is also sometimes called the ability of asphalt pavements to heal themselves during warm weather. A high asphalt content can enhance flexibility of an asphalt paving mixture.

Flexible Pavement: Another term for asphalt concrete pavement.

Fog Line: A longitudinal white line delineating the edge of the traveled way on a road.

Fog Seal: A light application of asphalt emulsion, without mineral aggregate cover, on an existing pavement. Fog seals reduce oxidation on older pavement.

Fracture Test: The fracture test, ATM T-4, is a visual determination of whether the larger aggregate particles are sharp-edged or rounded, expressed as percent fracture. Samples for fracture testing ensure that crushed aggregates have at least the minimum specified percentage of fractured particles.

Gap-Graded Asphalt: A gap-graded asphalt mix is essentially the same as an open-graded mix; however, the amount of fine aggregate in the mix is usually greater than the amount used in the open-graded mix. Gap-graded can occur because of aggregate gradations but can also be a design feature. The production, placement, and compaction of a gap-graded HMA mix are similar to the processes used for an open-graded mix.

Gradation: The relative size distribution of the particles in an aggregate sample. The percentages passing various sieve sizes, from the largest (100% passing) to the smallest (No. 200 sieve) show the gradation of the material.

Gradation Chart: A chart where the percentage passing various sieve sizes can be plotted, giving a visual demonstration of an aggregate's size distribution. Gradation charts with the sieve sizes (in inches) raised to 0.45 power on the x axis are most commonly used with paving aggregates. A straight line plotted on a 0.45 power gradation chart is a maximum density line, which is usually avoided in asphalt mix production. Gradations near the maximum density line have little space for asphalt, making the optimum asphalt range small.

Grooves: Grooves cut into pavement increase traction and moisture runoff and make ice removal easier. They are usually transverse to the direction of traffic. In Alaska, grooves are common on runway pavements at larger airports.

Heavy Trucks: Two-axle, six-tire trucks or larger, including trucks with heavy-duty, wide-base tires. Pickup, panel, and light four-tire trucks are not included.

High-Float Emulsion: AASHTO high-float emulsion derives its name from the fact that asphalt residue from distillation must satisfy a minimum float test in water at 140°F. High-float emulsion has the capability of wicking up into fine materials, unlike CRS-2, that basically only allow embedment of clean aggregate (chips). Typically HFMS-2s grade emulsion is used, that is, high-float, medium setting, high viscosity with solvent emulsion. It is considered an anionic emulsion. This is a specific type of emulsion that may contain up to 7% oil distillates, which can result in a softer residue that is less sensitive to low-temperature construction than CRS-2. The addition of solvent also helps the material coat aggregates and wick upward. High-float emulsion tends to develop a weak gel structure immediately after spraying, which creates resistance to flow on banked and crowned surfaces. The Yukon Territory uses a slightly different specification for high-float emulsions based on penetration and other slight modifications to the AASHTO specification.

High-Float Asphalt Surface Treatment: See **Single Surface Treatment**.

Hot Asphalt Recycling: Reclaimed asphalt pavement (RAP) is combined with new asphalt cement and new aggregate in a central mixing plant. Carefully consider the amount of RAP to allow in a mix because its addition cools the mix, which may impede proper asphalt coating of aggregates and hamper lay-down operations.

Hot Aggregate Storage Bins: In a batch plant, bins that store the heated and separated aggregates prior to their final hot screening into the pug mill.

Hot-Laid Plant Mixture: See **Asphalt Concrete**.

Hot-Mix Asphalt (HMA): See **Asphalt Concrete**.

Hveem Method: Alaska does not use this method.

Ignition Oven: A furnace that determines estimated asphalt cement content of an asphalt concrete mixture by burning off and exhausting the asphalt cement out, leaving only aggregates. It heats weighed samples of mixture at approximately 1,100 degrees Fahrenheit for one hour and the remaining aggregate is weighed after cooling, producing an estimate of the asphalt content of the mix. Pollution control devices on ignition ovens' exhaust stacks make them much less hazardous to the environment than previously used chemical extraction methods.

Impermeability: A material's resistance to the flow of air and water through it.

In Situ: In the natural or original position.

Initial Traffic Number (ITN): The average daily number of equivalent 18,000-pound, single-axle load applications expected for the design lane during the first year.

Intermediate Course (sometimes called binder course): An asphalt pavement course between a base course and an asphalt surface course.

Job-Mix Formula: An acceptable product of an asphalt concrete mix design, including aggregate gradation, optimum percent asphalt content, and other data determined in the mix design process.

Lay-down Machine: Asphalt pavers are also called lay-down machines. These self-propelled machines place asphalt concrete pavement. They consist of a tracked or wheeled tractor unit that pulls an activated screed. The screed spreads the asphalt concrete and partially compacts it by using its weight and sometimes vibrators.

Layer Coefficient (a₁, a₂, a₃): These are used in the AASHTO pavement design procedure, which Alaska does not use.

Layton Box: A box mounted on the tailgate of an end dump truck containing asphalt concrete mix. When the dump truck raises the bed, the hot mix slides into the Layton box, which allows paving in small areas such as trails and driveways.

Lift: A layer or course of paving material applied to a base or a previous layer.

Longitudinal Joint: Longitudinal joints run in the direction of paving. They are weak spots in the pavement and should be kept out of high-traffic areas. On highway projects, you must place them at lane lines or the centerline. In aviation projects, paving strips are normally at least 25 feet wide, which minimizes longitudinal joints. Placing hot asphalt concrete against cold pavement forms most longitudinal joints.

Lute (Asphalt Rake): A metal rake with triangular teeth that finishes hot asphalt overlays before rolling.

Manual Proportioning Control: In a hot or batch plant, a control system in which proportions of the aggregate and asphalt fractions are manually controlled by gates or valves. The system may include power-assist devices for the opening and closing of gates and valves.

Map Cracks: See **Cracks**, **Block Cracks**.

Marshall Method: Alaska uses this method. You may use the Marshall method for asphalt paving mixtures for laboratory design and field control of mixtures containing asphalt cement and aggregates not exceeding 1 inch. The test features density-voids analysis and stability-flow test on specimens of compacted asphalt paving mixtures. Equipment and procedures for the Marshall tests are outlined in AASHTO Method of Test T245 and ASTM Method of Test D1559.

Mastic: A mixture of asphalt and fine mineral material that may be poured into place and compacted by troweling to a smooth surface.

Maximum Density Line: A straight line, plotted on a 0.45 power gradation chart, that indicates a gradation with little void space for asphalt cement. An accepted way to illustrate the line is to connect the 0 point on the chart to the smallest sieve size with 100% of the material passing it.

Maximum Fines Content (P_{\max}): The maximum allowable fines content of a material at a given depth below the surface course.

Maximum Size of a Gradation: The smallest sieve size with 100% of the material passing it.

Maximum Specific Gravity: A theoretical maximum specific gravity of a paving mixture, at the zero air voids state, as determined by AASHTO T-209. The Rice specific gravity of a mix helps in calculating the percentage of air voids in a mix and the percentage of compaction. It is the reference for acceptance of asphalt concrete pavement compaction. The percentage of Rice specific gravity a mix has is its percentage of compaction. If you take 100% minus the compaction percentage, you will find the percentage of the volume of air voids in the mix. Also called “Rice specific gravity.”

Medium-Setting Emulsions: See **Emulsified Asphalt**.

Mesh: The square opening of a sieve.

Mineral Dust: The dust portion of the fine aggregate (P_{200}).

Mineral Filler: A finely divided mineral product, at least 70% of which is P_{200} . Pulverized limestone is the most commonly manufactured filler, although other stone dust, hydrated lime, Portland cement, and certain natural deposits of finely divided minerals are also used.

Mix Design Methods: See definitions for each of the following:

Marshall Methods

Superpave Procedures (Gyratory)

Hveem Methods (Stabilometer)

Mix Design Report: Contains information project materials inspectors need. On aviation and highway projects, the asphalt mix design becomes part of the contract. The asphalt content, aggregate, and temperature specifications listed on the mix design supersede the authority of the standard specifications.

Mixed-in-Place (Road-Mix): An asphalt course produced by mixing mineral aggregate and cutback or emulsified asphalt at the road site by travel plants, motor graders, or special road-mixing equipment.

Multiple Surface Treatment: Two or more surface treatments using asphalt and aggregate placed one on the other. The aggregate maximum size of each successive treatment is usually half that of the previous one, and the total thickness is about the same as the nominal maximum size aggregate particles of the first course. A multiple surface treatment is a denser-wearing and waterproofing course than a single surface treatment, and it adds some strength but is not assigned a structural coefficient. The following is a list of various MSTs:

Bituminous Surface Treatment (BST): Another term for an emulsified asphalt surface treatment (AST). A BST indicates a double-shot AST where the process of surface preparation, application of emulsified asphalt with a distributor, and application of graded aggregate chips with a chip spreader is done two or more times. In the Yukon Territory, BST is the name for high-float surface treatments.

Double-Shot Seal Coat: Similar to the chip seal but in a double application. It is durable, provides some leveling, and is available in a number of textures.

Triple Seal: Uses three applications of binder and three sizes of chips using CRS-2 or RS-2. It provides up to a 0.75-inch thick, flexible pavement. It provides a smooth, sealed, and tough-wearing surface.

Natural (Native) Asphalt: Naturally occurring asphalt derived from petroleum by evaporation of volatile fractions, leaving the asphalt fractions. The most important native asphalt is found in the Trinidad and Bermudas Lake deposits. Asphalt from these sources is often called Lake Asphalt.

Nominal Maximum Size of a Gradation: In geological terms, one sieve size smaller than the maximum size or the first sieve with any aggregate retained on it. In Superpave mix design technology, the nominal maximum size is the first sieve smaller than the maximum size, which retains at least 10% of the material.

Nuclear Gauges/Nuclear Density: Nuclear gauges are monitor compaction levels of mixes. The nuclear density gauge senses the reflection of gamma rays sent into the pavement; the greater the density, the more rays are reflected. The gauge must be calibrated for each paving mix.

Oil Content: See **Asphalt Content**.

Open-Graded Asphalt Mix (Friction Course): Open-graded hot-mix asphalt concrete creates friction surfaces to reduce hydroplaning, placed as overlays on new or existing pavements. Open-graded asphalt concrete contains a large proportion of coarse aggregate and a small proportion of fine aggregate. This leaves voids (openings) in the mix, which allow water to drain. This, combined with the coarse surface texture, provides a skid-resistant surface. The coarse material provides the structural strength of the pavement. The P_{200} size materials, combined with the asphalt cement, coat the coarse aggregate and cement it together. Open-graded asphalt concrete typically contains 20% or more air voids.

Optimum Asphalt Content: A term used in the Marshall design method. It is the design asphalt content at which the mix has a certain combination of stability, air voids, and density.

Overlay: A way to rehabilitate distressed asphalt concrete pavement. Overlays may be used to increase the design life before distress shows. They are best applied before the existing pavement has become too rough, cracked, and rutted. An application of emulsified asphalt tack coat is applied on the existing pavement prior to the overlay. The

thickness requirement for the overlay is a function of the structural condition of the existing pavement and the predicted future traffic loading.

Patching: Mending or repairing a roadway surface, usually with asphalt and aggregates.

Pavement Design Methods:

- California Bearing Ratio (aviation) (FAA)
- Excess Fines Method (highway) (see Guide for Pavement Design, PCM 1180)
- Mechanistic Method (highway) (PCM 1180)
- AASHTO Pavement Design Methods (highway)

Pavement Design Period (“n”): The number of years that a pavement is expected to carry a specific traffic volume and retain minimum serviceability without rehabilitation. This is optimized by the Pavement Management System.

Pavement Performance: The trend of serviceability in relation to load applications.

Pavement Price Adjustment: See **Quality Level Analysis**.

Pavement Rehabilitation: Work to extend the service life of an existing facility. This includes placement of additional surfacing material or other work necessary to return an existing roadway, including shoulders, to structural or functional adequacy. This could include the removal and replacement of the pavement structure.

Pavement Structure: The combination of select material, subbase, base, and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed (42 inches below the asphalt concrete layer).

Pavement Structure Combination or Composite Type: When the asphalt pavement is on old Portland cement concrete pavement, a Portland cement concrete base, or other rigid-type base, or is on a granular base, the pavement structure is called a combination or composite-type pavement structure.

Penetration: The consistency of a bituminous material expressed as the distance in tenths of a millimeter (0.1 mm) that a standard needle vertically penetrates a sample of the material under specified loading, time, and temperature. It can also refer to the depth the prime coat penetrates the base.

Percent Trucks (PTT): The percentage of annual average daily traffic (AADT) that is heavy truck traffic.

Predicted Deflection (D_p): The predicted maximum probable deflection of a proposed pavement structure due to an 18,000-pound, single-axle load.

Performance-Graded Asphalt: A product of the SHRP research program, sometimes called Superpave or PG graded binder (asphalt). A new asphalt grading system based on temperature extremes that the design pavement is expected to withstand. The laboratory grading system subjects samples of the binder to various tests at the extremes. Performance-graded asphalt receives a PG grade. For example, a PG58-28 is a binder that is supposed to withstand temperatures from 135° F to –20° F. The high temperature is the maximum ambient temperature the mix is expected to withstand for any seven-day period during the design life. The low temperature is the one-day expected low pavement temperature during the design life of the pavement.

Performance Period: The time that an initially constructed or rehabilitated pavement structure will last before reaching its terminal serviceability; this is also referred to as the design period.

Performance-Related Specifications: Specifications that describe the desired levels of key materials and construction quality characteristics that correlate with fundamental engineering properties predicting performance. These characteristics—for example, air voids in asphaltic pavements and strength of concrete cores—are

amenable to acceptance testing at the time of construction. True performance-related specifications not only describe the desired levels of these quality characteristics, but also employ the quantified relationships containing the characteristics to predict subsequent pavement performance. They provide the basis for rational acceptance and/or price adjustment decisions.—*TRB Circular #457. Glossary of Highway Quality Assurance Terms.*

Permafrost: Permanently frozen subsoil.

PG Grades: See **Performance-Graded Asphalt**.

Pickup Machines: Some contractors use belly dump trucks, which dump hot mix in windrows on the grade. Then a pickup machine, also called a windrow elevator, deposits the mix into the paver.

Pit-Run: Using aggregates from selected deposits as they exist naturally without further treatment such as screening.

Plant Mix: See **Asphalt Concrete**.

Plant Screens: In a hot or batch plant, the screens located between the dryer and hot bins that separate the heated aggregates into the proper hot bin sizes. Plant screens are also used with rock crushers and washing plants.

Pneumatic-Tired Roller: Self-propelled pneumatic rubber-tired rollers have two to eight wheels in front and four to eight wheels in the rear. The wheels oscillate (axles move up and down), and some may wobble. Self-propelled pneumatic-tired rollers vary in weight. Ballast can be added to the machines to increase the weight. Some machines have the ability to change tire inflation while the roller is operating.

Poise: A centimeter-gram-second unit of absolute viscosity. It is equal to the viscosity of a fluid in which a stress of one dyne per square centimeter is required to maintain a difference of velocity of 1 centimeter per second between two parallel planes in the fluid that lie in the direction of flow and are separated by 1 centimeter.

Prepared Roadbed: In-place roadbed soils compacted or stabilized according to applicable specifications.

Present Serviceability Index (PSI, p): A number that estimates the serviceability rating from measurements of certain physical features of the pavement.

Prime Coat (Highway and Aviation): A bituminous application used to prepare an untreated base for an asphalt surface. The prime penetrates into and seals the base and plugs the voids. It hardens the top, keeps the base from raveling, and helps bind the base to the overlying asphalt course. Highway Standard Specification 403-2.1 allows MC-30 liquid asphalt or CSS-1 emulsified asphalt as a prime coat. Aviation Standard Specification 600.2 allows MC-30 or CMS-2S emulsified asphalt. The contract special provisions may allow other materials.

Project Design Life (N): The total number of years a pavement will be in service before it will be reconstructed. This includes the years of life extended by asphalt overlays considered in the original design.

Pumping: The ejection of foundation material, wet or dry, through joints or cracks, or along edges of rigid slabs resulting from vertical movements of the slab under traffic.

Quality Level Analysis: This is also known as “pavement price adjustment,” “QC/QA,” “incentive/disincentive,” and “penalty/bonus.” The procedure provides a basis for deciding whether to accept, reduce payment for, or reject the paving material depending on its conformance with the specifications and its variability. A statistically random sampling plan is used for asphalt acceptance testing whenever the contract includes a price adjustment. Airport projects now always use pavement price adjustments.

Quality Control (Process Control) Tests: Tests done by the contractor to ensure the quality of the materials prior to use. The tests allow the contractor to correct deviations from specifications before placing the material.

Rapid-Setting Emulsions: The rapid-setting grades react quickly with aggregate and revert from the emulsion state to asphalt. The RS grades produce a relatively heavy film. They are used primarily for spray applications,

such as aggregate (chip) seals, sand seals, surface treatments, and asphalt penetration macadam. The RS-2 and CRS-2 grades have high viscosities to prevent runoff.

Raveling: The loss or dislodgment of surface aggregate particles from the edges inward or the surface downward. It is caused by lack of compaction, construction of a thin lift during cold weather, dirty or disintegrating aggregate, too little asphalt in the mix, or overheating of the asphalt mix. Studded tires can also contribute to raveling.

Reclaimed Asphalt Pavement (RAP): The removed or processed materials containing crushed asphalt pavement. In reuse, the RAP can be used for hot or cold recycling, mixed with base course, or used as a pure RAP base.

Resilient Modulus (M_R): A measure of the repeated-load modulus, sometimes called “dynamic” modulus of elasticity of roadbed soil or other pavement material. Stresses and strains are generated on test equipment using repetitive loading conditions. M_R should not be confused with another measure of the dynamic modulus known as the complex modulus (E^*). E^* is not presently used in mechanistic design methods used by DOT&PF.

Rice Specific Gravity: Same as **Maximum Specific Gravity**.

Rigid Pavement: A pavement structure that distributes loads to the subgrade, having as one course a Portland cement concrete slab of relatively high bending resistance.

Roadbed: The graded portion of a highway within top and side slopes, prepared as a foundation for the pavement structure and shoulders. It extends to such a depth as to affect the support of the pavement structure.

Roadbed Material: Material used in construction of the roadbed.

Road Mix: A method of combining aggregates and asphalt by use of a grader.

Roadway Structure: A combination of select subbase, base course, and surface course materials placed on a subgrade that supports the traffic load and distributes it to the elements of the roadbed.

Rock Asphalt Pavements: Pavements made of rock asphalt, natural or processed, and treated with asphalt or flux if required for construction.

Ross Count: A visual determination of how well the asphalt is coating the aggregate. The Ross count is performed on asphalt concrete at the asphalt plant and is an acceptance test for batch plants and an informational test for dryer-drum plants.

Ruts: Ruts are depressions that develop in the wheel tracks of a pavement. Ruts may result from consolidation or lateral movement under traffic in one or more of the underlying courses or by displacement in the asphalt surface layer. They may also develop under traffic in new asphalt pavements that had too little compaction during construction or from plastic movement in a mix that does not have enough stability to support the traffic. Studded tire wear can also cause ruts.

Sand Asphalt: A mixture of sand and asphalt cement or cutback or emulsified asphalt. It may be prepared with or without special control of aggregate grading and may contain mineral filler. Employ either mixed-in-place or plant mix construction. Sand asphalt is used in construction of base and surface courses.

Sand Equivalent Test: The sand equivalent test indicates the relative proportion of detrimental fine dust or clay-like materials in mineral aggregates used for asphalt paving mixtures and mineral aggregates or soil used for base courses.

Sand Seal: A seal coat of spray-applied CRS-1 or RS-1 with a sand cover. It reduces raveling, restores uniform cover, and enriches dry, weathered pavement.

Scarify: To mechanically loosen the surface.

Screed Unit: The screed unit is attached to the tractor unit on a lay-down machine by long screed pull arms on each side of the machine. The screed pull arms provide the screed with a floating action as it travels along the road, automatically compensating for surface irregularities within the “wheel base” of the paver. As the tractor unit pulls the screed into the material, the screed seeks the level where the path of its flat bottom surface is parallel to the direction of the pull, planing up or down to the required paving thickness as the screed angle of attack is adjusted.

Seal Coat: See **Single Surface Treatment**.

Segregation: The separation of the coarse and fine aggregate particles in an asphalt mix. The segregation of the mix can occur at several locations during the mix production, hauling, and placing operation. Some mixes are more prone to segregate than others. Asphalt mixes that have large top-size coarse aggregates (1 inch or greater), low asphalt cement contents, and are gap graded will segregate more readily when handled than a dense-graded mix of optimum asphalt content and a smaller top-size coarse aggregate. Segregation lessens pavement durability by increasing the air void content of the mix, which increases the potential for moisture damage. Segregated locations are susceptible to raveling and, if bad enough, to disintegration under traffic.

Selected Material: A suitable native material obtained from a source such as a particular roadway cut or borrow area, having specific characteristics.

Serviceability: The ability, at time of observation of a pavement, to serve traffic that uses the facility.

Settlement Test: Detects the tendency of asphalt globules to settle during storage of emulsified asphalt. The procedures and equipment are prescribed in AASHTO Method of Test T59 and ASTM Method of Test D244.

Sheet Asphalt: A hot mixture of asphalt cement with clean, angular-graded sand and mineral filler. Its use is usually confined to surface course, and it is laid on an intermediate or leveling course.

Shoving: Displacement of a concrete asphalt layer in any direction. An unstable or tender mix can cause shoving. It can take place during the compaction operation or later, under traffic.

SHRP: The acronym for the Strategic Highway Research Program. It is a federally funded research program, begun in 1987 as a five-year operation with goals of improving methods of design, construction, and maintenance of asphalt concrete and Portland cement concrete pavements. SHRP research funds were partly used for the development of performance-based specifications to relate laboratory analysis with field performance. The program was completed in 1995, with only the portion on long-term pavement performance (LTPP) still ongoing.

Sieve: In laboratory work, an apparatus with square apertures that is used for separating sizes of material. Sieve sizes are given in two ways: large sizes (sieves with holes 1/4 inch or more) are named by the opening width, such as 1 inch, 3/8 inch. Smaller sieves are numbered, i.e. #4, #200. The number corresponds to the number of openings per linear inch of screen.

Sieve Analysis: A mechanical sieve shaker shakes a weighed quantity of aggregate over a set of sieves with various sizes of square openings. The sieve with the largest opening is on top and those with successively smaller openings are nested beneath. A pan below the bottom sieve collects the material as it passes through. The material retained on each sieve is weighed and expressed as a percentage of the weight of the original or total sample.

Sieve Test: The sieve test complements the settlement test and has a similar purpose. It determines the percentage of asphalt present in the form of relatively large globules. The procedure and equipment for the sieve test are found in AASHTO Method of Test T59 and ASTM Method of Test D244.

Single Axle Load: The total load transmitted by all wheels of a single axle extending the full width of the vehicle.

Single Surface Treatments: A single application of asphalt to any kind of road surface followed immediately by a single layer of aggregate of uniform size. The thickness of the treatment is about the same as the nominal

maximum-size aggregate particles. A single surface treatment is a wearing and waterproofing course. The following is a list of SSTs:

Chip Seal: A chip seal or “single-shot” asphalt surface treatment is the spraying of emulsified asphalt material (CRS-2 or RS-2) followed immediately by a thin stone cover. This is rolled as quickly as possible to create adherence between the asphalt and the aggregate cover. The chips (or stones) range from 3/4-inch aggregates to sand and are predominately one size. It produces an all-weather surface, renews weathered pavements, improves skid resistance and lane demarcation, and seals the pavement.

High-Float Asphalt Surface Treatment: A single-shot asphalt surface treatment where one application of high-float emulsion is applied to the prepared surface followed by a single application of crushed gravel cover coat. The gradation of cover coat aggregate used in high-float emulsion surface treatments are typically similar to those used for crushed aggregate base course (D-1), except with 100% passing the 3/4-inch sieve rather than the 100% passing the 1-inch sieve as with D-1. The fine aggregates allowed in high-float operations may cause segregation of larger materials and blockage in the chip spreader if they are not very dry. Therefore, maintain strict moisture content control of cover coat materials. High-float asphalt surface treatments are more easily constructed in areas with dry climates, such as interior Alaska. In the Yukon, high-float asphalt surface treatments are called “BST.”

Skid Resistance: The ability of an asphalt paving surface, particularly when wet, to offer resistance to slipping or skidding. The factors for obtaining high skid resistance are generally the same as those for obtaining high stability. Proper asphalt content and aggregate with a rough surface texture are the greatest contributors. The aggregate must not only have a rough surface texture, but also resist polishing. Aggregates containing nonpolishing minerals with different wear or abrasion characteristics provide continuous renewal of the pavement’s texture, maintaining a skid-resistant surface.

Slow-Setting Emulsions: The slow-setting grades are designed for maximum mixing stability. They are used with high P_{200} content, dense-graded aggregates. The SS grades have long workability times to ensure good mixing with dense-graded aggregates. All slow-setting grades have low viscosities that can be further reduced by adding water. These grades, when diluted, can also be used for tack coats, fog seals, and dust palliatives. The SS type of emulsion depends entirely on evaporation of the water for coalescence of the asphalt particles. The SS emulsions are generally used for dense-graded aggregate-emulsion bases, soil asphalt stabilization, asphalt surface mixes, and slurry seals.

Slurry Seal: A slurry seal is a maintenance operation intended to fill minor depressions and provide an easily swept surface. It is made with fine crushed aggregate mixed with quick-set emulsified asphalt (RS grades). The liquid slurry is machine-applied with a sled-type box mounted on the back of a truck, containing a rubber-edged strike-off blade.

Snivey: A stainless steel nozzle attached to the spray bar on the back of a distributor that controls the shape and volume of asphalt being sprayed on the roadway.

Softening Point: The temperature at which asphalts reach an arbitrary degree of softening. The softening point is usually determined by the ring-and-ball test method.

Solubility: A measure of the purity of asphalt cement. It is that portion of the asphalt cement that is soluble in a specified solvent such as trichloroethylene. Inert matter, such as salts, free carbon, or nonorganic contaminants, is insoluble.

Specific Gravity: Specific gravity is the ratio of weight of any volume of material to the weight of an equal volume of water, both at a specified temperature. Thus, a specific gravity of 1.05 means that the material is 1.05 times as heavy as water at the indicated temperature. The specific gravity of asphalt is usually determined for two reasons: (1) to permit a calculation of voids of compacted asphalt paving mixes, or (2) to adjust quantities of aggregate components of a paving mix, where such components vary appreciably in specific gravity. The specific

gravity is determined by the hydrometer method as prescribed in AASHTO Method of Test T227 and ASTM Method of Test D3142.

Stability: The ability of asphalt paving mixture to resist deformation from imposed loads. Stability depends on internal friction and cohesion.

Static Steel Wheel Roller: Static steel wheel rollers normally range in weight from 3 to 14 tons. The gross weight can be adjusted by adding ballast, but this adjustment cannot be made while the roller is operating and is not normally changed during the term of a paving project.

Stoke: A unit of kinematic viscosity, equal to the viscosity of a fluid in poises divided by the density of the fluid in grams per cubic centimeter.

Stone Mastic (Matrix) Asphalt Pavement (SMA): SMA is a product that is relatively new in America. It was developed by contractors in Western Europe who are subject to giving warranties for their work against rutting. It is often used to rehabilitate areas with premature rutting failure due to studded tire wear. SMA optimizes stone-on-stone contact in the mix. It is gap-graded, hot mix asphalt with a large proportion of coarse aggregates (amount passing 0.08 inch limited to approximately 20%) and a rich asphalt cement/filler mastic. The coarse aggregates form a strong structural matrix. Asphalt cement, fine aggregate, filler, and stabilization additive form a mastic that binds the structural matrix together. The coarse aggregates are highly fractured and roughly cubical stone. Relatively high asphalt contents (about 6.5% of the total mix) provide for a durable pavement. A stabilizing additive, usually 0.3% cellulose from ground newspapers, is included in SMA to prevent hot asphalt cement from draining down during hauls.

Stress Reduction Factor (SRF): The factor by which the stress of an applied load at the surface of a pavement is reduced at a given depth below the surface course.

Structural Number (SN): This is part of the AASHTO pavement design procedure that Alaska does not use.

Subbase (SB): The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a base course (or in the case of rigid pavements, the Portland cement concrete slab). If the subgrade soil is of adequate quality, it may serve as the subbase.

Subgrade: The top surface of a roadbed upon which the pavement structure and shoulders are constructed.

Subgrade, Improved: Subgrade, improved is a working platform achieved (1) by the incorporation of granular materials or stabilizers such as asphalt, lime, or Portland cement, prepared to support a structure or a pavement system, or (2) any course or courses of select or improved material placed on the subgrade soil below the pavement structure. Subgrade improvement does not affect the design thickness of the pavement structure.

Superpave Procedures: The term Superpave stands for Superior Performing Asphalt Pavements and is a product of the SHRP asphalt research. The Superpave system incorporates performance-based asphalt materials characterization with design environmental conditions to improve performance by controlling rutting, low temperature cracking, and fatigue cracking. The three major components of Superpave are the asphalt binder specification, the mix design and analysis system, and a computer software system.

The Superpave mix design process uses a gyration compactor to compact mixes. A gyratory compactor uses a rotating flat steel plate that is forced down upon the mix contained in a steel cylinder. The number of gyrations required for a mix design is determined from the expected equivalent single axle loads (ESALs) and the design seven-day maximum air temperature.

The Superpave mix design differs most significantly from the currently used Marshall mix design process in that it requires the designer to try various gradations in order to determine the one(s) that will meet the voids criteria at all three gyration levels.

Surface Course (SC): One or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer of flexible pavements is sometimes called “wearing course.”

Tack Coat: A tack coat is a thin application of asphalt material applied to a previously paved surface to ensure that an overlay will adhere to the existing surface. It is recommended to place a thin coat on any cold edges of new paving such as joints, gutter lines, and around manholes, etc. For application, a slightly damp (not wet) surface is preferable to a dry, dusty one.

Tandem Axle Load: The total load transmitted to the road by two consecutive axles extending across the full width of the vehicle.

Tar: A material resulting from the process of combusting coal, sugar, wood, or other organic material.

Test Categories: DOT&PF divides material tests into five categories:

Acceptance: Project materials inspectors perform acceptance tests. They document whether a specific lot of a pay item (such as asphalt concrete) meets particular specifications for the item (such as gradation). DOT&PF accepts and pays for materials using acceptance tests.

Assurance: The Regional lab usually performs assurance tests. These are used as checks on acceptance tests to ensure that procedures and test equipment are working correctly.

Information: Information tests are made on samples taken during the production of materials prior to the point of acceptance. The gradation of aggregates, for example, is often checked as it is being crushed. Either project materials personnel or the regional laboratory may make information tests.

Quality: State or Regional Materials Laboratory generally performs quality tests. They determine whether raw material has acceptable qualities. Gravel, for example, is tested for hardness and durability.

Quality Control: The contractor performs these tests to ensure the materials meet the contract requirements and makes adjustments to the construction process if the materials begin going out of specifications.

Thin Film Oven Test: The thin film oven (TFO) test actually is not a test. It is a procedure intended to subject a sample of asphalt to hardening conditions approximating those in normal hot-mix plant operations. Viscosity or penetration tests made on the sample before and after the TFO test are considered a measure of the anticipated hardening.

Traffic Equivalence Factor (e): A numerical factor that expresses the relationship of a given axle load to another axle load in terms of their effect on the serviceability of a pavement structure.

Transverse Joint: Transverse joints are placed wherever paving is ended and begun again at a later time.

Travel Plant: Travel plants are self-propelled pug mill plants that mix the aggregates with asphalt, applied at a controlled rate, as they move along the road.

Traveled Way: The portion of the roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

Treated Base Courses: Asphalt treated bases may be divided into two categories: (1) hot asphalt treated, and (2) emulsified asphalt treated. These two categories may be further subdivided into dense graded and open graded (permeable) bases. Dense graded bases are the materials typically specified for highway construction. Open graded bases require special considerations. One purpose of any treated base is to provide improved structural support for paving. When using asphalt treated base course, you may substitute a portion of its thickness for the thickness of asphalt concrete pavement required by structural design.

Dense Graded Asphalt Base: Uses hot asphalt cement as a binder and is designed to be constructed much the same as asphalt concrete pavement. These are usually D-1 gradation with asphalt binder.

Open Graded Asphalt Base: Made from crushed porous aggregates treated with hot asphalt binder. This material's use is limited in particular applications. It is asphalt treated in order to provide stability during construction. Production and lay-down of open graded asphalt treated base is similar to asphalt concrete pavement except compaction requirements, in terms of number of roller passes required, are determined by a test strip.

Triple Seal: See **Multiple Surface Treatments**.

Truck Factor: The truck factor is the number of equivalent 18,000-pound single-axle load applications contributed by one passage of a single vehicle. Also see also **Equivalent Single Axle Loads (ESAL)**.

Unified Soil Classification System (USCS): USCS is a classification used in airport construction projects. The unified soil classification system is based on textural characteristics for those soils with such a small amount of P_{200} that the P_{200} does not affect soil behavior. It is based primarily on the characteristics that determine how a soil will behave when used as a construction material. The USCS places soils into three divisions:

- Coarse-grained
- Fine-grained
- Highly organic

The USCS is designed so that visual inspection and simple field tests can classify these primary group soils. Tests used in the field identification are dilatancy or shake test, dry strength, and toughness or consistency near the plastic limit. Unified soil classification symbols for components, gradation, and liquid limit are:

Component	Symbol
Boulders	None
Cobbles	None
Gravel	G
Sand	S
Silt	M
Clay	C
Organic	O
Peat	Pt
Well graded	W
Poorly graded	P
High Liquid Limit	H
Low Liquid Limit	L

Unit Weight: The ratio of weight to the volume of a substance. For example, the unit weight of water is 62.4 lbs/ft³ at 40° F.

Vibratory (Vibrating) Roller: Vibrating rollers are made with one or two smooth-surfaced steel wheels. They vary in static weight. Vibratory rollers are used for compacting any type of asphalt mixture but should not be used in the vibratory mode when the mat thickness is 1.5 inch or less.

Vibratory Screed: The vibratory screed is highly effective in initially increasing the density of the asphalt mat placed by the paver. Its operation is similar to the tamping screed but the compaction effort generated by the screed is derived from electric vibrators, rotating shafts with eccentric weights, or hydraulic motors.

Viscosity: A measure of the resistance to flow. It is one method of measuring the consistency of asphalt.

Absolute Viscosity: A method of measuring viscosity using the poise as the basic measurement unit. This method uses a partial vacuum to induce flow in the viscometer.

Kinematic Viscosity: A method of measuring viscosity using the stoke as the basic measurement unit.

Viscosity Grading: A classification system of asphalt cements based on viscosity ranges at 140° F. A minimum viscosity at 275° F is also usually specified. The purpose is to prescribe limiting values of consistency at these two temperatures; 140° F approximates the maximum temperature of asphalt pavement surface in service in the U.S., and 275° F approximates the mixing and lay-down temperatures for hot asphalt pavements. There are five grades of asphalt cement based on the viscosity of the original asphalt at 140° F.

Voids/Voids in the Mineral Aggregate (VMA): Nearly all the volume of asphalt pavement is filled by aggregate particles. Asphalt or air fills the remaining spaces (voids).

Void Volume: Total empty space in a compacted mix.

Wearing Course: Where thick pavements are required, the asphalt concrete pavement is sometimes placed as two layers, each differing in composition but sharing approximately the same fatigue properties (see also **Binder Course**). The wearing course is the top portion of asphalt concrete pavement, “tuned” to provide maximum resistance to abrasion wear (addresses tire-stud rutting), minimum surface roughness (addresses ride quality), minimum plastic deformation (addresses displacement rutting), and minimum permeability (addresses premature weathering and aging of the asphalt concrete).

Wet Mixing Time: The interval between the beginning of application of asphalt material and the opening of the mixer gate.

Workability: The ease with which paving mixtures may be placed and compacted.

Yield: Refers to the quantity of asphalt concrete pavement that is laid in the paving operation. An estimating factor is calculated, based on the expected unit weight of the compacted mixture, the width of the screed, and the planned thickness of the mix. This estimating factor is in terms of weight per lineal measure of paving. Using this and net weights of mix from truck scale tickets, asphalt inspectors can see that the paving operation is proceeding properly toward the planned quantity of asphalt concrete mix and avoid overruns. Adjustments in the pavement thickness may be made, based on yield calculations, in order to match the planned tonnage of mix.

Zeta Potential: The measurement of zeta potential is a relatively new test for evaluating asphalt emulsions and is not an AASHTO or ASTM test. It measures stability in a colloid system with a laboratory device known as a zeta meter. The zeta meter measures the speed of move placed in an electrical field. This test has particular value in evaluating cationic emulsions. The level of zeta potential is a general indication of the setting characteristics of the emulsion.